Lesson 5b: Why Do Different Sub-Species of Wolves Have Different Trait Variations?

Overview:

Purpose:

The purpose of this activity is to describe how random fluctuations in gene frequency in a population are the result of the random sorting and recombination of genes in sexual reproduction (through meiosis and fertilization) and to explain why this drift in gene frequency can result in the loss of alleles from a gene pool. Students will extend this idea to help students 1) describe the relationship between population size and the rate of gene loss from a gene pool and 2) explain why barriers that cause reproductive isolation of a genetically diverse ancestor population would likely lead to offspring populations that have different gene pools from on another.

Connection to previous activities:

Students have identified two sets of natural occurring mechanisms that could lead to populations with different traits: 1) those due to natural selection and 2) those due to genetic drift. Students will use both possible mechanisms to explain the distribution of different sub-species of wolf in the world, arguing for which traits variations between sub-species most likely due to natural selection, and which are more likely due to genetic drift (no competitive advantage in their environment for the predominant trait variations).

Performance Expectations

- Build a model to show patterns in variations of a trait based on geographic location for different to support an **explanation for whether natural selection** or genetic drift most likely **led to adaptation of the populations to its environment** (*in wolf sub-species).* **HS-LS4-4.**

- Argue from evidence and critique other arguments for why some similarities and differences in trait variations between sub-species of wolves are more likely to be the result of natural selection rather than random selection events (genetic drift) or vice-versa.

Description

Students investigate case study #2, analyzing one trait in nine sub-species of wolves. They represent the patterns in this data on a map map showing the distribution of the trait variations geographically, in order to support a claim as to whether the trait variation was more likely the result of natural selection or genetic drift.

Students present their map and argue their claims to class based on the evidence they analyzed, and "sister" research groups engage in argument or consensus building with this group. Audience members record the consensus claim (if any) of the two research groups.

In their homework they apply these experiences and understandings to describe why population fragmentation from geographic barriers in combination with the mechanism of genetic drift could lead to populations with very different gene pools and traits over time.

Lesson Details:

Time: 60-75 minutes

Materials

Per Student

- Color print of Case Study #2 Student Activity Sheet.pdf found in the zip file for Case Study Introduction handout and printouts.
- Color print of Case Study #2 Data Packet.pdf found in the zip file for Case Study Introduction handout and printouts.
- Individual copy of Reading 5.1 – Random Events and Reading 5.2 Genetic Drift Population Size.

For Teacher

- 1 piece of butcher paper or poster paper or space on the wall for students to stick the post it notes on.
- Document camera or other display technology for student's to display their maps/models.

Lesson Outline and Timing

Launch

- Overviewing page 1 of case study handout 2 (5 min)

Explore – Case Study #2

- Partners use handout to analyze data, create a map, and make claim based on the data (20-min.)

Summarize

- Expert group "round table" presentations - arguments from evidence (35 min.)

Lesson Enactment Details

Launch:

Pass out Case Study 2: Gray Wolf Sub-species handout to each student.

Read page 1 and 2 of this together as class. Have students make their individual predictions at the top of page 3.

Explore:

Assign two groups of students to have the same trait, working separately from one another with 2-3 people in each group. Repeat this for all four traits. This will yield 8 groups of students, with two groups working on each trait. This is designed so that when the groups report out their findings they can argue alternate claims or establish consensus by comparing each other's findings in front of their classmates

Tell students to read step 1 and 2 on page 3, and use the last 3 pages of the data packet and the maps to summarize their discoveries.

After 10 minutes, have all groups look at page 4. Explain that their goal is to now annotate their map on page 4 with a new key showing where some of the variations they researched occur and to complete the first row of the table on page 5. Tell students to read through directions #3-5 in the student data packet.

Summarize:

When all groups have completed this (approximately 10 minutes), have them present their claim, map, and reasoning to the class (about 2-3 minutes per group) using a document camera. The sister group that also researched this trait should be ready to link in to the first group's argument, explaining if and why they agree, or if they don't agree why not. If both sister groups present and can't come to consensus through questioning each other and arguing from evidence, the class and the groups can decide to leave the claim for this trait "unanswered".

As each group presents, tell stuents to record the claim of the group, whether their map/model supports their claim, and the reasons the additional reasoning the group provided to support their claim.

Homework Assigned:

None